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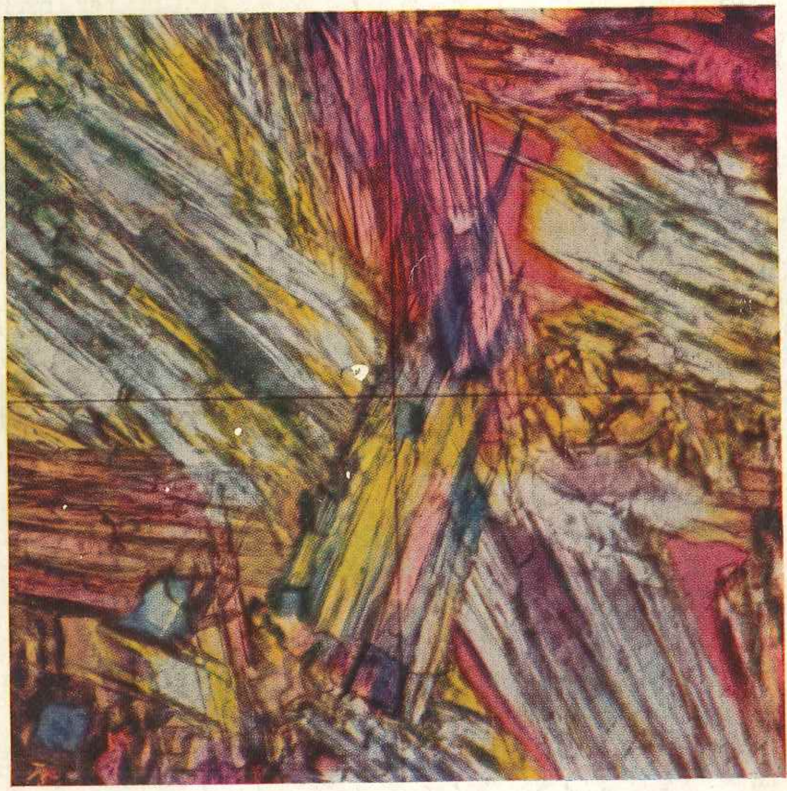
The Educational FOCUS



A photographic section of vitrefrax mullite made by Thomas F. Curtis with B & L equipment.—— An article by Mr. Curtis appears on page four of this issue

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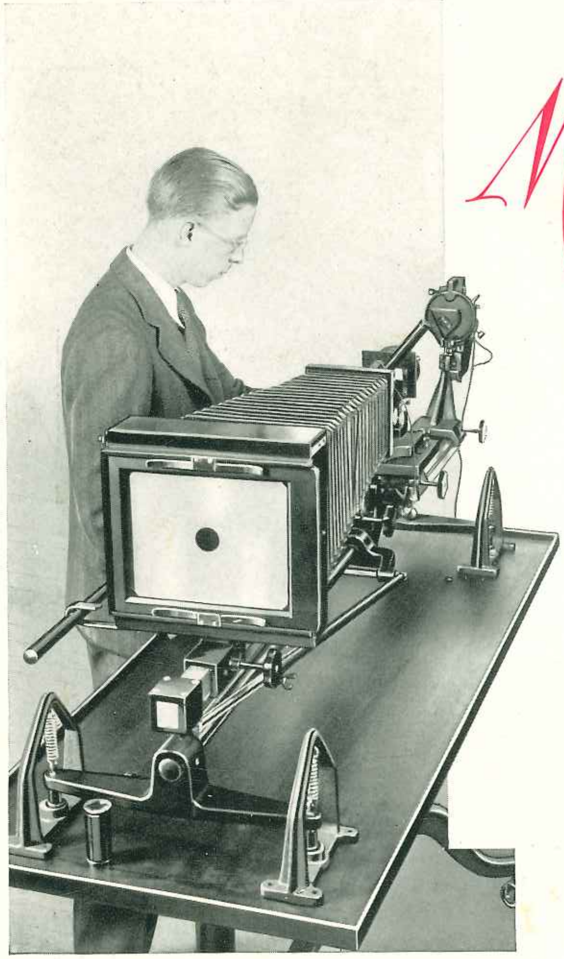

MR. CURTIS used the type of equipment illustrated here to make the photomicrograph reproduced on the cover of this issue.

Mr. Curtis and many of his contemporaries have chosen Bausch & Lomb equipment because of its absolute photographic rigidity.

The many new features incorporated in the Bausch & Lomb epuipment, such as all metal camera back, long bearing and smooth moving camera supports, permanent alignment, the Observation Eyepiece for easily locating the specimen and focusing, make this new model ideal for exacting photomicrographic work.

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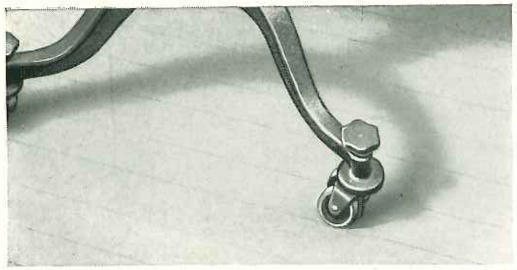
BAUSCH & LOMB OPTICAL
COMPANY
619 St. Paul St., Rochester, N. Y.

PHOTOMICROGRAPHIC EQUIPMENT



Catalog on Photomicrographic Equipment will be sent on request

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The Educational FOCUS

Published quarterly by the Bausch & Lomb Optical Co., Manufacturers of Optical Equipment, for the promotion of the use of Optical Instruments in Education

VOL. I SEPTEMBER, 1929 NO. 2

A Vision

¶ A decade ago William A. E. Drescher, Treasurer of Bausch & Lomb Optical Company, hopefully visualized a great American Institute of Applied Optics. Today, with the foundation of a Department of Optics at the University of Rochester, his vision has become a reality. To further develop this institution so that it will become analogous to the Department of Optics at the famous University of Jena, Germany, is the aim of the organizers, the University, Bausch & Lomb Optical Company and Eastman Kodak Company.

¶ At the University, the Department of Optics will occupy an entire floor of the J. J. Bausch-Henry Lomb Physics Building. This building represents a gift of three hundred thousand dollars made by members of the Bausch and Lomb families.

¶ Ten years ago, a vision—today, a reality. We prophesy that within the next ten years this department will gain world-wide recognition—will far surpass the greatest hope of its organizers—will be another source of scientific enlightenment for the world.

HINTS *from a* Photomicrographer's Notebook

By THOMAS S. CURTIS
Director of Research, Vitrefrax Co.
Los Angeles, Calif.

Time savers used in the daily production of photomicrographs both in natural color and in monochrome. Picked at random from the technique of the Research Laboratories of Vitrefrax Corporation.

THERE appears to be a widespread notion that the making of photomicrographs is a matter of great difficulty,—an operation fraught with uncertainty, and one requiring endless patience and perseverance.

When the beginner learns, as he must, that the slightest touch of the focusing wheel is sufficient to make or spoil his picture through the microscope, his hands shake and his fingers become thumbs. Even the advanced worker seems to become panic-stricken, particularly when working with high powers, when a mere touch of the slide may hopelessly lose the desired field after hours of work in composing the picture. This fear must first be overcome.

Facing the necessity of producing as many as fifty shots per day, at times, ten or more in full natural color through a petrographical instrument under polarized light, the Vitrefrax Corporation quickly realized that the first essential in the establishment of a workable and dependable technique, was to *standardize the operations.*

The standardization process consisted in establishing a routine method of doing everything, changing only the materials or the size to fit the job in hand.

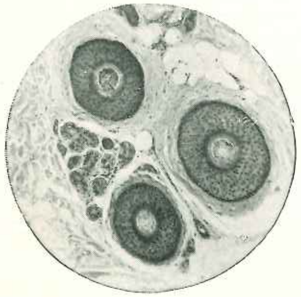
At the start of the day's work, every element in the optical system is wiped lightly but thoroughly with lens paper. Every week-end, the condenser is removed from the lamp and washed with warm, soapy water to remove the veil of volatilized elements of the carbon electrodes which collects on the inner condenser surface.

Before starting the work, the optical centering of the arc is tested and a clear, white field obtained on the ground glass when viewed through a Heide Actinometer turned to afford a weak illumination.

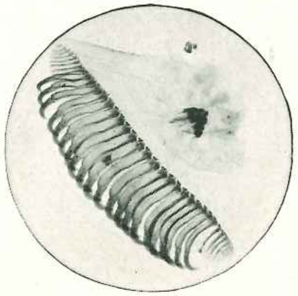
A useful dodge to slightly diffuse the image of the arc crater and at the same time to permit full intensity of illumination to reach the sub-stage condenser, is to fit an Eastman Pictorial Diffusion Disc over the condenser mount in the arc lamp housing. It just happens that the Disc supplied with the large Eastman Enlarger fits the condenser mount of the Bausch & Lomb arc lamp. This device so softens the image of the arc crater that the so-called "critical illumination" of the object may be effected without having danger of false color zones appearing in the field while doing color separation work. It also minimizes the damage done by flying particles which are projected from the crater of the arc and which have been known to cause rather sharply-defined streaks in the negative.

The log of the day's work is kept in a stenographer's notebook on the microscope table. This includes all necessary identification records and notes on optical phases of the work and a record of the exposure time, filters, plates used, etc.

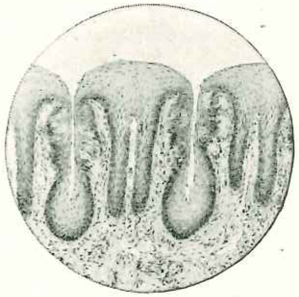
For monochrome work, we have



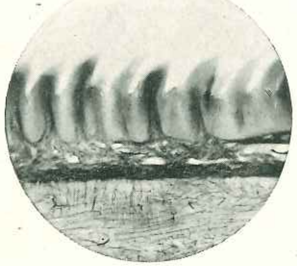
Photomicrograph of scalp with hair magnified 45 ×



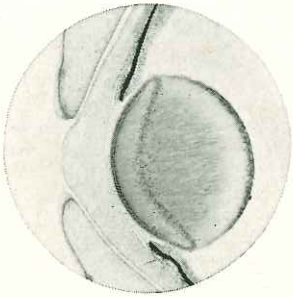
Foot of caterpillar magnified 20 ×



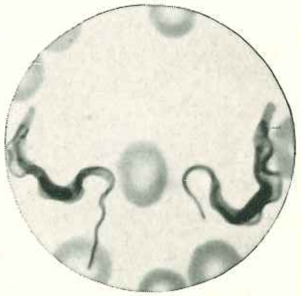
Section of tongue magnified 60 ×



Tongue of cat magnified 20 ×



Embroyonic eye of a pig magnified 25 ×



Protozoan parasite in blood magnified 1200 ×

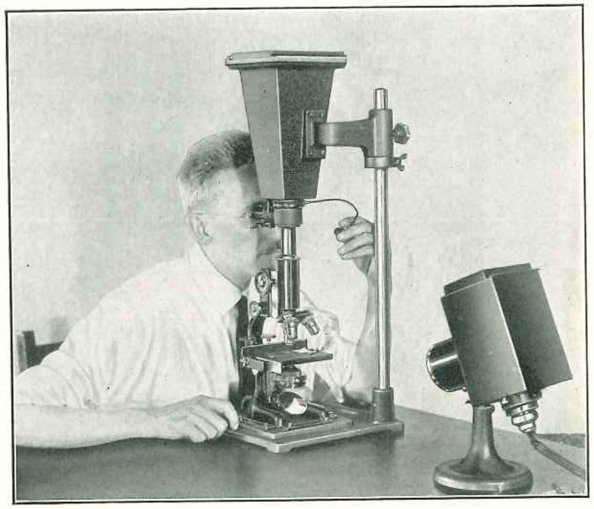
standardized on Eastman Process Plates if the subject is not in colors or if it is of one predominating color. The reason for this choice is because of the wide range of contrast obtainable, the slow speed which facilitates darkroom handling. If the subject requires strong, vigorous contrasts for its delineation, we use a simple Nepera Solution developer, in a strength of 1:6 at 65°F. developing for about two minutes. If it is necessary to restrain contrasts in order to preserve delicate detail, we slightly increase the exposure, and develop with Nepera Solution 1:12 for from one to two minutes at 65°F.

For monochrome rendering of subjects in colors, such as a thin section of mineral under polarized light, we prefer the Wratten M plate which is fully panchromatic and which has a wide range of contrast with a very fine-grained emulsion. For quick, routine work in black and white, from colored subjects, we again use Nepera Solution for developing, treating the same as for the non-color-sensitive Process Plates. A 1:5000 Pinakryptol Green desensitizer solution, applied for one minute in total darkness before development, enables us to develop in the usual red safelight in perfect comfort and with no fog.

For natural color rendering by means of color separation negatives, we again use the Wratten M Plate, but in this case prefer the D-76 Borax Developer of Eastman Kodak Co. to the Nepera Solution, since, in a set of tri-color negatives, beautifully modeled rendering is necessary in the scale of tones to produce a faithful tri-color print. For detailed description of the technique employed, the reader is referred to "Photomicrography in Natural Color"* by the author.

All plates are purchased in lots that will afford a three months' supply of a single emulsion number. This enables us to determine filter ratios and speeds with the sacrifice of a single plate, instead of making it necessary to test a plate from each box.

The Nepera Developer in diluted form will keep several days if immediately replaced in a tightly stoppered bottle and kept cool in the dark. The Borax Developer, unless exhausted from too frequent use, seems to improve in quality with age.



The Bausch & Lomb K Camera in use showing how the photographer can observe the view while making the exposure

(Continued on page 20)

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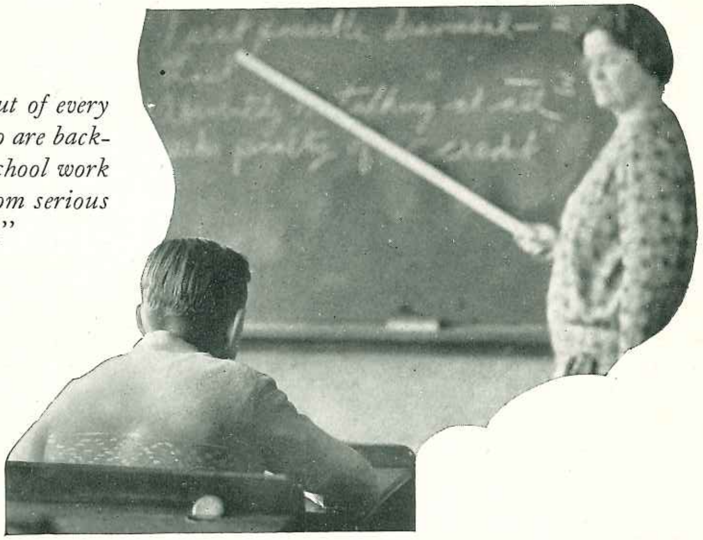
* Photomicrography in Natural Color, published by Vitrefrax Corporation, Los Angeles, Calif. Copy upon request.

B*lurred* Blackboards

"Probably five out of every ten children who are backward in their school work are suffering from serious defective vision."



THE above statement was made by Doctor Hillard Beards. "When properly fitted with glasses," he continues, "these students are advanced to their proper places in school." As the head of the Eye Department of the Research Hospital of the University of Illinois and the State Department of Public Welfare at Chicago, Doctor Beards is in a position to obtain the facts from which he derives the above statement.

From another source we obtain confirming information that seven hundred and seventy-six sturdy young men averaging nineteen years of age—the entering class of a great university—were put through the standard physical examination, and of the seven hundred and seventy-six, there were three hundred and seventy-five, or 48%, who had defective vision.

A similar test in the entering class of young women revealed that 55% had subnormal eyesight.

These statistics in themselves are not serious, for many of the students whose eyesight is defective already wear glasses and enjoy the benefits of good vision. The appalling fact, however, is the number who are allowed to neglect this urgent need. Had these students, in their early life, been given the proper treatment undoubtedly the percentage handicapped by poor vision would closely approach zero.

Much work is now being done towards reaching this goal. Fortunately, eye examination by a school nurse is rapidly becoming extinct. School executives now realize that no one but an eye-specialist is competent to make such an examination.

The time is approaching when good eyesight, or eyesight corrected with proper glasses, will be one of the entering requirements in our high schools and universities as well as compulsory in the grade schools. It cannot come too soon.

Classroom Equipment for Visual Instruction

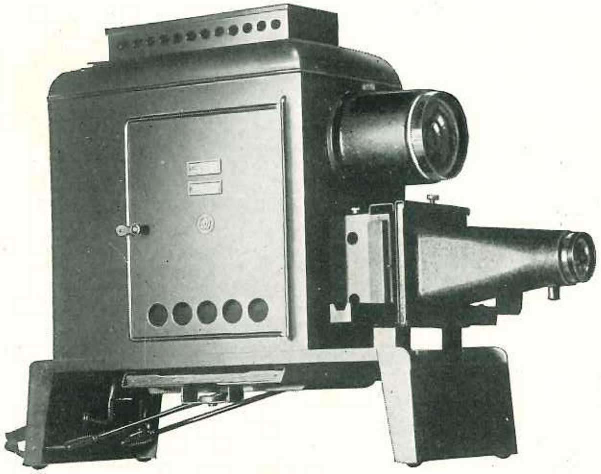
By A. W. ABRAMS

Director Visual Instruction Division, State Education Department, University of the State of New York

IN the following discussion it is assumed that the use of visual aids is to be a recognized part of the regular program of instruction in the school. Some of the facts stated are, however, suggestive also for those who are interested in visual aids only for mass instruction or for occasional class exercises. This article deals specifically with equipment for still pictures, but most of the statements are equally applicable to motion picture equipment.

No claims are presented for the value of the use of pictures in teaching. No person, however, has any right to disclaim or question either the importance or the practicability of a program of visual instruction on the basis of his own experience or his observations of the work of others in this field, if, in his experience or observations, the vital problem of adequate and suitable equipment has been disregarded.

Necessity for equipment. Visual instruction requires the use of physical equipment. The field of study for which this means of teaching is especially effective is that of the objective world. Things—material objects that have form, size, position and some that have color and motion —that can not be seen and studied at all directly by most pupils, and very few of which can be brought into the classroom at the particular time they are needed for observation, if ever, need to be represented by pictures. The only pictures that are useful for class instruction are those which are large enough to be seen by the entire class at the same time and studied under the guidance of the teacher. Pictures projected to adequate size upon a screen satisfy this requirement. Such pictures necessitate a special equipment.



A picture of the LRM Balopticon. Now refer to the illustration on the opposite page

Equipment to be provided by the board of education. In a school where projection apparatus is purchased, perhaps on the installment plan, with funds raised by teachers and pupils through candy sales, entertainments, and the like, visual instruction can hardly be said to have official recognition.

Those schools succeed best in which the board of education and the administrative head directly, or through a properly constituted representative, make a study of all the problems involved, reach a decision as to what equipment should be provided and make purchases with regular school funds precisely the same as furniture and other equipment are selected and bought.

Standard lantern. The laws of light and lenses do not change. Very few radical improvements have been made in projectors since they were first introduced except those which result from the substitution of the incandescent lamp for the arc lamp formerly used. Select what long experience has shown to be the standard type of equipment. Consider particularly the quality of the lenses used in the projector.

Screen. The screen is a very important part of projection equipment. The old-fashioned coated screen of the reflecting type is most satisfactory for general use. Light should be reflected from the screen evenly at all angles. It should be adequate in amount but soft in quality.

The screen should be large enough to accommodate a picture of sufficient size to be read as to details from the rear seats without eyestrain. If, on the other hand, the picture is too large, it flattens out, that is, perspective is lost for persons sitting in the front of the room. For a classroom of the usual size, with the most distant pupil about 27 feet from the picture, the screen should be 6 x 6 feet in dimension.

If a cheap screen is bought, it will probably be found to be mounted on a wooden roller rather than a metal one and that the roller wabbles or

(Continued on page 22)

The Balopticon is a projection instrument for projecting both opaque objects and lantern slides upon a screen. The lamp house is the largest part of the machine and at the top is an elevated section with holes in the side to provide ventilation. On the right hand side of the instrument is a door which also has a row of ventilation holes along the bottom. The upper lens system is used for projecting opaque objects and is enclosed in a cylindrical section extending from the front of the lamp house. The lower lens system is for projecting lantern slides. In the lower lens system is a slide carrier which holds two slides and travels from one side to the other. The entire instrument sets on a bench shaped base which elevates the instrument from the surface upon which it stands. Underneath the base is a rectangular shaped card holder which is attached to the instrument by means of a spring arm. This holder is for holding the opaque objects in place while they are being projected on the screen. The instrument is black with nickel trimmings.

This word description occupies the same amount of space as the LRM picture, from which illustration do you learn more about the instrument

Behavior *of* CRYSTALS *with* Polarized LIGHT

By

Dr. E. M. CHAMOT

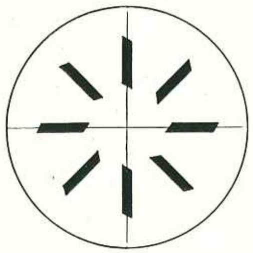
of the Laboratory of Chemical Microscopy,
Dept. of Chemistry, Cornell University.

The examination of test drops on the stage between crossed Nicols affords us most valuable information, and is constantly used in the progress of an analysis. Since the beginner first tries the comportment (between crossed Nicols) of known substances treated with various reagents, only an elementary knowledge of the various phenomena which can occur is essential. It is undoubtedly possible to perform successful micro-chemical analyses without having recourse to polarized light, yet the use of this accessory is such a valuable aid, that every student should examine each and every preparation between crossed Nicols. He will thus soon learn more than could be told him in pages of writing. All interested in micro-chemical work unfamiliar with this division of crystallography are urged to consult the standard text-books devoted to the subject.

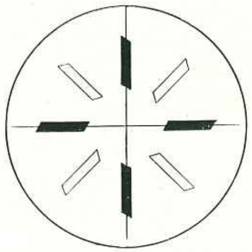
For the beginner a few general statements and directions can be given which will be useful in analytical work.

In the following directions, reference is made to the microscope designed by the author of the present series of articles. The instrument is now supplied with condensing lenses, fitting above the polarizing Nicol, to furnish strongly converging polarized light; and with selenite plates, red and green, of the first order. These plates are unmounted and can be used either above the polarizer or above the eyepiece.

When a crystal is placed on the stage of a microscope near the center of a field between crossed Nicols, and the stage turned, the crystal will behave in one of two ways. 1. It will remain dark throughout a complete revolution of the stage (see diagram A, Fig. 1), that is: there is no change in its appearance in the dark field. 2. As the stage is turned the crystal will alternately become bright or colored, and alternately disappear (extinguish). In this case two possibilities arise. Either the crystal disappears (extinguishes) when its axes coincide with or are parallel to the cross-hairs, and is brightest midway between (see diagram B), or the position of extinction is not on the cross-hairs, but lies a little to one side (is oblique to) the cross-hairs (see diagram C). In the former case we speak of the crystal as having parallel extinction, and in the latter as having oblique extinction.



A



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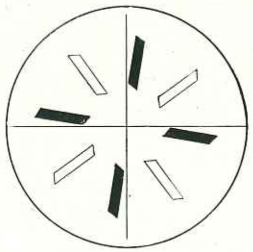


C

These phenomena give evidence (not proof) as to the crystallographic system to which the substance belongs.

The different crystal systems behave normally as follows:

Isometric—Crystals remain dark in all positions in which they may be placed, and throughout a complete revolution of the stage (Diagram A).

Tetragonal—Parallel extinction in two positions of the crystal (B), and in the third direction no action (A).

Orthorhombic—Parallel extinction (B) in all directions through the crystal.

Monoclinic—Parallel extinction in two directions and oblique extinction (diagram C), in the third.

Triclinic—Oblique extinction in all three directions.

Hexagonal—In one direction has no action and so remains dark throughout a complete revolution of the stage. In other directions exhibits parallel extinction. (Compare with tetragonal.)

It is evident that the observation of a single crystal just as it lies in the field of the microscope gives insufficient information to lead to a decision as to its system. Moreover, it is seldom indeed that in the course of analytical work a crystal is obtained which is of sufficient size, or proper shape, to permit its being turned over so as to allow an examination by polarized light in different directions.

The problem is, therefore, not so simple as it would appear at first sight. Besides, it will be seen that, when lying in certain positions, examination with plane polarized light will not yield definite information. Recourse must then be had to strongly converging polarized light as given below.

In the vast majority of cases, the test drop will yield a field in which crystals can be found lying on different faces. Thus a careful search will generally enable the worker to pick out, here a crystal in which the light is transmitted in the direction of one axis, there another crystal in which it is sent through in the direction of another axis. Several crystals should be examined; and a decision must never be formed from the examination of one crystal only.

For *E*ase *of* *M*anipulation

USE THE FS MODEL

A popular microscope extensively used by high school and college students for biological work. Special equipment gives it a range of magnifications adequate to meet the requirements of work in the scholastic laboratory. Easy to manipulate and of sturdy construction, it is an excellent instrument for the student unused to handling a microscope.

Write to Bausch & Lomb Optical Co., 619 St. Paul St., for information on the FS series

A New Microscope

—for the *Research Laboratory*

Bausch & Lomb Optical Company presents an innovation in microscope design — a microscope *with the stage directly in front of the user.*

When exhibited for the first time at the Marine Biological Laboratory at Woods Hole, Mass., many favorable comments were made on this new design, which is a decided departure from that of previous microscopes.

The DDE is characterized by the minimum of effort and the maximum of comfort for continued observation over long periods of time.

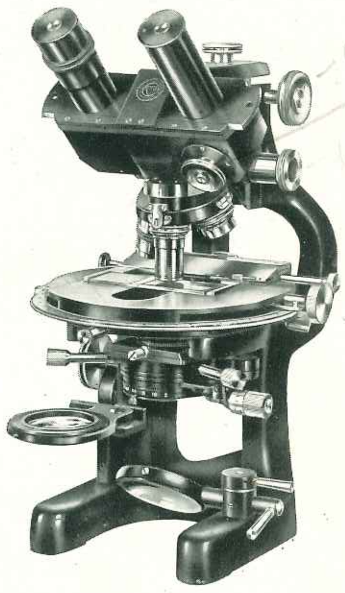
Dr. L. W. Sharp, of Cornell University, suggested the design of DDE.

An article on the DDE appears on the opposite page.

BAUSCH & LOMB OPTICAL COMPANY
619 ST. PAUL STREET, ROCHESTER, N. Y.

The RESULT of a Conversation

The word New is often promiscuously used to describe products which are merely revised models. It is used, however, to the fullest extent of its meaning in connection with the DDE Microscope.


coarse
moves [illegible]
fine

The Bausch & Lomb New Research Microscope DDE

MORE than a year ago, when one of Bausch & Lomb representatives called upon Doctor Lester W. Sharp of Cornell University, the conversation turned to research microscopes and the convenience of their manipulation and the idea of a "turned about" position was advanced.

This discussion lead to intensive research and experimentation on the part of the Bausch & Lomb Scientific Bureau and resulted successfully in the production of the research model DDE.

The "turned about" position of the new microscope brought to light many changes in design and many new features became necessary to obtain the convenience, accuracy and comfort in keeping with the new idea.

To sit at the microscope in an upright position is an extraordinary *comfort.* To change instantly from binocular to monocular vision and back again is a *convenience.* To focus the condenser for highest power work and leave it in position when going to low power by swinging in an auxiliary condenser for suitable illumination is *efficiency.* To set the mirror at the proper angle and clamp it in position is *time saving.* To focus a fine adjustment which carries only the weight of the objectives, assures the highly controlled action necessary when working at high magnification. To manipulate the substage adjustments immediately in full view of the workers is an outstanding convenience.

The above facts prove that the New DDE closely approaches the ideal.

The Student's NATURAL SCIENCE ASSOCIATION

Nearly every American student has a hobby. Literary clubs, camera clubs, art clubs and many other such student activities are established among the students of the schools so that students with the same hobbies may get together. Following, is a "Student's Natural Science Association," proposed by Bausch & Lomb Optical Company.

A NATURAL SCIENCE CLUB, carried on outside of the school, is ideal as a means of giving practical science instruction to scientifically minded students, and as a means of giving general information and culture to all students interested.

The tendency is always toward real practical knowledge rather than theoretical text book knowledge. In such clubs, not being subject to the hard and fast rules of the class room, the students are given a greater opportunity for freedom and self expression, which, of course, is very helpful.

The advantages of a natural science club are many. Several distinct and important advantages, however, manifest themselves at once.

1. First hand knowledge of plant and animal life is retained longer and more easily than book knowledge by the average student.

2. Greater freedom for the student is offered, giving him opportunities for self expression and research not attainable in the classroom.

3. Pupils bring in more and varied types of specimens, make more microscope slides and study them with greater interest than is generally manifest in the classroom.

4. A greater opportunity is offered the teacher to cooperate closely with the students and to encourage those who show particular promise in biological and scientific research.

5. Thru the formation of a Student's Natural Science Club, more and better instruments will be available for study than if the students had to obtain them individually.

6. Lastly, a powerful incentive to obtain actual first hand knowledge and to value it over and above book knowledge is instilled in the young student. This habit of thinking, studying and judging individually

is a trait which will be valuable thruout the student's life and which, as every teacher knows, is sometimes undeveloped in the average student.

The method of forming a Student's Natural Science Club is comparatively easy. It is preferable that the Biology teacher be the faculty advisor because the leader should be one with sufficient knowledge of general science to direct the activities of the club intelligently. In almost any school there are a number of pupils who will at once be enthusiastic over the formation of the club and many others, when shown the advantages and opportunities, will join.

The Bausch & Lomb AA Microscope an ideal model for the beginner in microscopy

Teachers of science classes can interest pupils of the proposed club by outlining the activities, their advantages, and the opportunities for individual expression offered in this field. An interesting and attractive point can be made by showing the opportunities for hikes and field work, as well as for actual practical microscopy and laboratory work, including the making of microscope slides, mounting of specimens, etc.

As far as club procedure is concerned there are many things that a Natural Science Club can do and these should be equitably distributed throughout the year's program. Indoor work should consist of the making of slides, mounting specimens, making examinations with drawings and possibly printing and developing photographs taken by students on field trips. An occasional meeting taken up by the reading or narrating of nature stories will add greatly to the enjoyment and knowledge of the members and at the same time serve as a guard against monotony.

Field trips should be taken frequently for the gathering of specimens and, what is probably even more important, for the observation of plants, animals and natural objects in their immediate habitat. The camera and a small instrument called the telemagnifier, for observing insects and animals at short distances without frightening them, are particularly valuable. Of course, the specimen box should never be forgotten. Whenever possible, a good pair of binoculars will add greatly to the enjoyment of the trip.

The Bausch & Lomb Optical Company has prepared a model constitution for individual clubs. It is recommended by the Student's Natural Science Association because it is simple and unrestricted. We urge interested teachers to write us, in care of the Focus, and full and complete information regarding the actual formation of the club, acquisition of equipment, etc., will be gladly sent to you.

The UNSEEN Ingredients

In the belief that the purchaser of an instrument is interested not only in the product but in the organization behind it, we present here a few interesting facts concerning the Bausch & Lomb Optical Company.

A FAMOUS artist was once asked, "What do you mix your paints with?"

"Brains," he replied.

The worth of any product is determined just as surely by the unseen ingredients as by visible evidence.

Microscopes, Balopticons, Colorimeters—all are simply structures of glass and metal, differing among themselves by reason of the unseen factors that go into their construction. Let us consider these factors because they have a most pertinent significance in regard to the instruments that you purchase.

Experience! What an overworked word and yet how important a factor in the design of optical instruments.

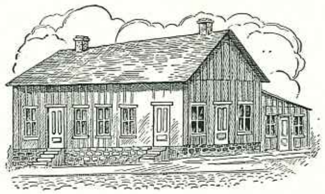
The Bausch & Lomb Optical Company, a pioneer in the field, is naturally proud of its three-quarters of a century service. It has a right to boast of the Early Settler's organization, a group of 250 employees who have been with the company 25 years or more.

But what has gone into these years in service is the measure of what they have taken out in experience. Starting as a manufacturer of eyeglass frames and lenses, the Bausch & Lomb Optical Company rapidly increased this line until today they are America's greatest producer of optical equipment of all kinds.

Naturally, the experience gained in one line of products has been most valuable in the production of others.

The Early Settlers Club. All of these people have been actively associated with Bausch & Lomb for over 25 years

The fact that Bausch & Lomb produces the Range Finders that have helped to make Uncle Sam's Navy the worlds' most accurate marksmen may not seem to have much to do with the quality of other optical apparatus. But consider — that all Bausch & Lomb products are designed by the same technicians, manufactured in the same plant under the same careful and painstaking supervision, according to the same high standards of quality. Bausch & Lomb quality is not and never has been an accident.



Bausch & Lomb first factory as it appeared in 1866

Research Facilities play an important part both in the development of new equipment and in guarding and guiding the quality of our regular line. So it is that we have a mechanical laboratory to control measurements, study the performance and texture of various materials and guard the mechanical precision of Bausch & Lomb instruments; a chemical laboratory for research experiment, inspection and analysis of raw materials, and the derivation and improvement of chemical formulae; a glass plant laboratory maintained for the exclusive purpose of controlling the quality of Bausch & Lomb glass.

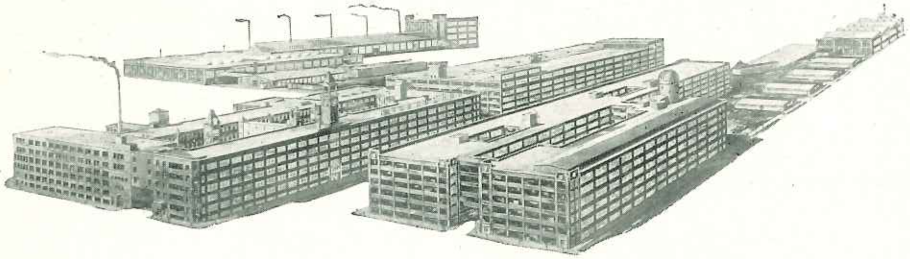
The most important Bausch & Lomb contribution to optical progress, however, may be found in the Scientific Bureau. This is composed of a group of scientists who are responsible for the optical design and perfection of all our optical products. To them must go a large share of the credit for most of Bausch & Lomb's scientific and optical achievements.

It is our belief that no product can be better than the materials of which it is comprised. The performance of any optical instrument, whether it be an eyeglass lens, a photographic objective, a photomicrographic outfit, or whatnot, is based upon correct design and quality materials.

That is why Bausch & Lomb started its own glass plant many years ago—a plant that proved of inestimable value to the government during the war and which since has enabled them to rigidly control the most important raw material that goes into an optical instrument.

The control of Bausch & Lomb quality goes back even farther than the production of the glass. A little three story plant is devoted solely to

(*Continued on page 21*)



The huge Bausch & Lomb plant of today

An accurate *Equatorial Telescope of* small size

PRACTICAL in every way for astronimical work of a serious order, mechanically perfect in construction and universal in application, this instrument is ideal for academic institutions who do not require expensive observatory apparatus.

A convenient means is provided for raising or lowering the polar axis to the proper latitude. Clock work can be furnished which will run for several hours with a single winding, thus keeping a celestial object in the field without using tangent screws.

This model is also suitable for observing terrestrial objects, being furnished with the prism erecting systems for that purpose.

Bausch & Lomb Optical Co.
619 St. Paul Street, Rochester, N. Y.

Hints from a Photomicrographer's Notebook

(Continued from page 6)

Our standardization of technique includes a method of judging exposures which consists in viewing the ground glass image through the Heide Actinometer in which an empirical scale has been worked out by trial and error. The exposure is judged against the deepest shadow, and the reading taken on the Actinometer scale. A series of test exposures of the same subject shadow instantly tells the correct time which is plotted against the Actinometer reading, and establishes the ratio of theoretical to actual exposure for that emulsion number of plates.

Test exposures are made for each emulsion number on a small plate. Filter factors are determined for tricolor work by photographing a well graded neutral grey subject by ordinary light (with no prisms).

Every plate holder is serially numbered, and every plate upon loading is marked on the back or glass side with a wax negative pencil with the corresponding number, for identification purposes. After the plate has been dried, the permanent record data are lettered on the bottom of the emulsion side in India Ink and the wax figures wiped off the back.

In summing up the technique which has made photomicrography a standardized, routine process, it may be said that orderly routine and methodical planning have contributed more to the success of our methods than any highly specialized knowledge or gifted ability.

The Unseen Ingredients

(Continued from page 19)

the manufacture of the pots in which the glass is made. These, too, must be uniform in quality and free from iron or other impurities.

Facilities have been touched upon in the preceding paragraphs. But those mentioned are but few of the many highly specialized departments housed in the several buildings which comprise the Bausch & Lomb plant. These buildings have a floor space well in excess of one million square feet and some comprehension of the size can be gained from the study of the illustration we are reproducing. In addition to the major divisions responsible for the production of optical and mechanical parts there are a host of other departments handling printing, case making, lacquering, plating, designing, blue-printing, foundry work, etc. Here, too, may be found Rochester's largest dining room, maintained for the convenience of employees.

Man power is an unseen ingredient of priceless value. It is of interest that Bausch & Lomb employ thousands of people but it is much more important to know that these employees are skilled craftsmen and executives, most of them specialists in the work to which they are devoted. Bausch & Lomb's ideals and standards is fostered by a tradition of 75 years.

These are a few of the intangeable qualities that you seldom see or hear about that go into Bausch & Lomb products. These are the invisible ingredients that add to the simplest magnifier or the most complex research instrument—that intangible asset generally referred to as "Bausch & Lomb Quality."

Your Optical Service Station

ANY problems, any questions, any difficulties you might have regarding optical methods or equipment — send to the Bausch & Lomb Optical Company.

Their scientific personnel and research department are at your service.

Use the post card attached inside the back cover to tell us about your requirements.

BAUSCH & LOMB
OPTICAL CO.
619 St. Paul St., Rochester, N.Y.

Classroom Equipment for Visual Instruction

(Continued from page 9)

that the diameter of the roller is less than one and a half inches, which is what it should be.

The screen should be suspended at such a height that, when drawn down, the bottom is at the level of the heads of the pupils. If lower than this, pupils in the front of the room cut off part of the picture for those sitting farther back. If too high, those seated near the front of the room are forced to hold the head in a tiring position.

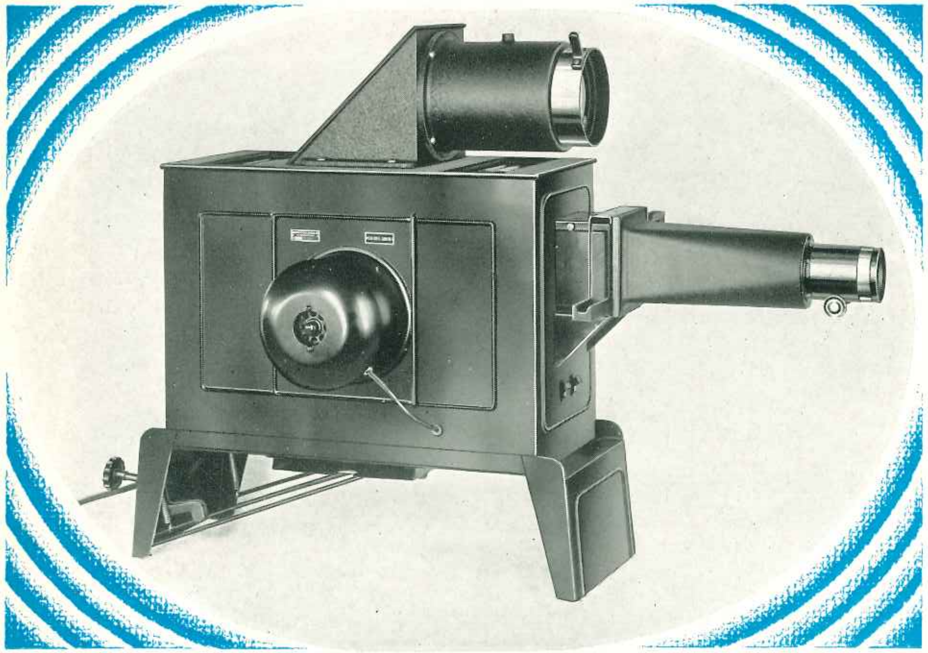
Darkening the room. All windows in the classroom should be provided with opaque shades by which daylight may be completely excluded from the room. The supporting fixtures should be attached to the face of the casing and the shades be wide enough to overlap the casing by at least two inches on each side.

There are times when some light should be admitted into the room in order that pupils may refer to books or write while a study of screen pictures is being conducted. The shades may then be raised a little without having too much light fall upon the screen itself. The electric lights of the room may also be flashed on for the time during which light is needed. For some pictures all or at least nearly all light should be excluded from the room except that coming from the projector.

Support for lantern. Many persons assume that a stereopticon or other projector may advantageously rest on some pupil's desk while being operated and lanterns have been constructed with a concentrated base adapted to such use. A lantern stand of suitable height is preferable. The light should be projected from the lantern as nearly as practicable at right angles to the screen. If it is projected obliquely, as it must be when the lantern is placed on a desk, the top of the screen is farther from the slide than the bottom is and critical definition in the screen image is impossible.

Individual classroom equipment. It is sometimes claimed that it would be too costly to provide each classroom with screen, outlets and shades. From a purely economic standpoint a school can not afford to do less. Saving of time should be secured in the school as much as in the factory. The time consumed in moving a screen soon amounts to more than the cost of another screen. The attempt to move classes to a special room for lantern exercises must largely defeat the ends of visual instruction. Too many pictures are used at one time and they are not used when they would be most effective. A picture, like a map or a blackboard sketch, should be used at the moment it is needed in the course of a class exercise as an aid to an understanding of the problem under consideration at the time.

Cost relatively small. Lantern slide equipment is relatively inexpensive. A classroom in a modern school building costs from $10,000 to $15,000. The teacher's salary must be paid. The cost of fuel, insurance, janitor service and supplies must all be counted in the cost of instruction. Visual instruction equipment lasts a long time. Adequate classroom equipment adds but a few cents per pupil to the annual cost of instruction.



Improved Illumination,
Easy Manipulation—

THE new CR Balopticon—designed to meet the increasing demand for a high-grade combined projection machine. A newly designed lamphouse and cooling device make possible the use of two 500 watt lamps backed with parabolic mirrors for opaque projection.

The two lamps give excellent, even illumination over the entire area. A separate 500 watt lamp is used for lantern slide projection. A tumbling switch changes the type of projection.

A mechanical control permits the user to raise or lower the platform, or to hold it in any desired position so that both hands are free to remove or insert the specimen.

[COMPLETE INFORMATION WILL GLADLY BE SENT ON REQUEST]

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619 St. Paul Street Rochester, N. Y.

The AKW5 — *Ideal for the*
SCHOOL SCIENCE LABORATORY

EXTREMELY wide field, long working distance, high eyepoint, stereoscopic vision, an erect unreserved image, a revolvable nosepiece, and instantaneous magnification changes, make the AKW5 particularly adaptable for the school science laboratory. Ellipsoidal reflecting surfaces of the wide field lamp direct rays into every crevice and recess of the specimen.

These features especially adapt the AKW5 for biological dissecting work and chemical crystalline structure observation, etc.

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